

REMARKS/ARGUMENTS

The Amendments

The amendment to the specification corrects an obvious typographical error. As this amendment clearly adds no new matter to the application, Applicants earnestly solicit its entry.

Claim 1 has been amended to more particularly point out and distinctly claim the subject matter Applicants regard as the invention. The claim now clearly identifies the feature or function that is enhanced and clearly identifies what part of the vegetation is exposed to the electron beam. To impart additional definiteness, the energy of the electron beam is characterized and quantified. These amendments are supported in the specification at page 1, lines 5 to 19; page 3, lines 10 to 26, and page 5, lines 1 to 4. Applicants respectfully submit that these amendments add no new matter to the specification, and earnestly solicit entry thereof.

Dependent claims 2 and 3 have been cancelled.

The Invention

The invention is a method of enhancing the take of a nitrogen fixing microorganism, i.e., adherence of nitrogen fixing microorganisms or formation of nodules on roots of a plant, without causing damage to the plant. The method comprises exposing the desired site on the epidermis of the plant's seed or body to a low-energy electron beam having an energy between 100 keV and 500 keV and providing an adequate dose for enhancing the take of the nitrogen fixing microorganism on the plant roots. Thus-treated seed or plant body then is transplanted into soil.

The Office Action

Claims 1-4 were pending and examined.

Claims 1-4 stand rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter Applicants regard as the

invention. In particular, the phrases ‘enhancing the take of’ and ‘exposing it’ were identified as indefinite.

All claims stand rejected under 35 U.S.C. § 102(b) as anticipated by Takeshita (“Radiation Effect ...”) in light of evidence by Parniske (“Plant Defense Response ...”). Takeshita is described as teaching plant growth-enhancing effects of low-energy irradiation. In particular, root growth and the presence of phytoalexin activity in soybean plants are said to yield a ‘reasonable believe [sic]’ that the nitrogen fixing microorganisms had formed nodules on the soybean roots. The office action further states that phytoalexin induction is a plant first response to microbial infection, including take of nitrogen fixing microbes, as evidenced by Parniske. Thus, Takeshita is said to anticipate the claimed invention.

Claims 1 and 2 stand rejected as anticipated under 35 U.S.C. § 102(b) over Tellefson, US 5,117,579. Tellefson discloses a method for enhancing nitrogen fixation, and so is said to anticipate the pending claims.

All claims stand rejected under 35 U.S.C. § 103(a) as unpatentable (obvious) over Tellefson and Takeshita in light of evidence by Parniske. Recognizing that Tellefson is directed toward treatment of plants in soil and is silent regarding dose, the office action points out that Takeshita encompasses irradiation of seeds before planting and discloses dose and energy suitable to stimulate growth. Further, Takeshita’s teaching that irradiation induces phytoalexin activity in soybean plants is said to induce activity of nodule microbes or nitrogen fixing microbes, as evidenced by Parniske. The office action asserts that phytoalexin induction or accumulation is a plant’s first response to microbial infection.

The office action asserts that, in view of this information, it would have been obvious to a skilled practitioner to irradiate plants with a low-energy electron beam with a reasonable

expectation of success in promoting plant growth as related to “plant-microbial interaction and nitrogen fixation.”

The Prior Art

Takeshita refers to an English-language abstract of a Japanese-language article. The abstract discloses that the effect of a low energy electron beam on growth of maize, barley, and soybean was investigated after irradiation with 2 to 20 kGy using electron beams with energies from 150 to 250 keV. Growth was promoted for maize and soybean seeds irradiated with a dose of *up to* 10 kGy. Root growth was promoted for irradiated barley and soybeans. Also, for soybeans, phytoalexin induction activity was enhanced by low energy electron beam irradiation.

Parniske discloses that, in initial stages of interaction between mutant bacteria and soybeans, plant defense reactions occurred, including phytoalexin accumulation, which was one of the earliest effects observed. Parniske is not directed to use of electron beams.

Tellefson discloses an electrical ion emitting farm implement. Wire brush-like ion emitters are disposed within an array of bell-shaped housings to form the apparatus. The apparatus is moved over a field of crops planted in earth for fixation of nitrogen in the ambient environment. As disclosed at column 2, lines 60-64, the ion emitter “is believed to cause chemical reactions in the air converting free nitrogen from a form unavailable to plants, to forms available to plants, as for example, nitrates, nitrites, ionic nitrogen compounds, etc.” Tellefson is silent with regard to plant identity and nodule formation.

The Invention In View Of The Prior Art

Applicants respectfully traverse the rejections. The claims have been amended to particularly point out and distinctly claim the subject matter applicants regard as the invention. The phrase ‘exposing it’ has been clarified by reciting precisely the plant and seed parts subject

to irradiation in the electron beam. Also, it now is clear that the claim is directed to enhancing the take of nitrogen-fixing microorganisms or formation of nodules on the plant's roots. The rejections on the merits are not well-founded.

Claims 1-4 were pending. However, claim 1 has been amended, and claims 2 and 3 have been cancelled.

Applicants respectfully submit that the claims are not anticipated by Takeshita 'in light of evidence' in Parniske. Applicants respectfully submit that the premise upon which the rejection is based, i.e., that nitrogen-fixing organisms had formed nodules on roots of irradiated soybean plants, is not well founded. Rather, Takeshita is directed to improved root growth. Pointedly, Takeshita is silent with regard to nodule formation or nitrogen-fixing organisms. Takeshita describes only that low-energy electron beam irradiation promoted growth, and that phytoalexin induction activity is an early response to microbial infection. Further, Parniske discloses only that phytoalexin accumulation is observed in early stages of microbe/plant interactions.

It is within the knowledge of the skilled practitioner that phytoalexin is induced with infection by microbes. Indeed, Parniske discloses as much. The Office Action asserts, by the rejection, that phytoalexin induction can be caused only by nitrogen-fixing organisms. However, the skilled practitioner recognizes that *any* microbe/plant interaction, including microbes other than nitrogen-fixing microbes, can induce phytoalexin activity in plants. Takeshita describes no precautions against infection by microbes already in the medium in which the soybean seeds were planted for growth evaluation. Indeed, counsel is informed that, in the Japanese-language document, Takeshita describes that the irradiated soybean seeds were transplanted into outdoor soil containing soil bacteria. In any event, there is no evidence that phytoalexin induction activity was the result of enhanced take of nitrogen-fixing organisms (nodulation).

Applicants respectfully submit that neither Takeshita nor Parniske, nor 'Takeshita in view of evidence of Parniske,' suggest or disclose the claimed invention. Thus, the claims are in condition for allowance over this rejection.

Claims 1 and 2 stand rejected over Tellefson. Applicants respectfully submit that the pending claims are neither suggested nor disclosed by Tellefson, and Applicants respectfully traverse this rejection. Tellefson is directed to a method and apparatus for enhancing nitrogen fixation by applying ions over crops planted in earth. The apparatus is believed by the inventor to cause chemical reactions in the atmosphere. These putative reactions convert nitrogen from a form unavailable to plants to forms available to plants.

Thus, it is clear that Tellefson is directed only to nitrogen fixation, and not to nitrogen-fixing microorganisms. There is no mention of soybeans in Tellefson, and there is no suggestion or disclosure of the claimed invention in Tellefson. Applicants respectfully submit that the claims are in condition for allowance, as Tellefson neither suggests nor discloses the claimed invention.

All claims stand rejected as obvious over Tellefson and Takeshita 'in light of evidence by Parniske.' The office action recognizes that Tellefson is directed to treatment of plants in soil and is silent regarding dose, and points out that Takeshita is directed to irradiation of seeds before planting and discloses conditions suitable for growth stimulation. Parniske's evidence is described above.

Applicants respectfully submit that Takeshita and Tellefson cannot reasonably be combined, as they are not directed to the same topic. Tellefson is directed to ionization to produce a particular chemical reaction in the air; Takeshita is directed to growth enhancement by irradiation. Thus, the skilled practitioner would not combine these two documents, and would

not look to the combination as a solution to the problem of increasing the take of nitrogen fixing organisms. Further, one would not know which features of each to adapt in the combination, and the combination does not result in the claimed invention.

The differences between Takeshita and Tellefson are myriad. Takeshita is directed to irradiation of seeds with particular doses; Tellefson is directed to production of ions in the vicinity of plants in the field. The skilled practitioner would not look to one to solve a problem with the other. Takeshita is a modification of seed or plant; Tellefson is a chemical modification of nitrogen in the vicinity of a plant. The skilled practitioner would not look to one to solve a problem posed by the other. These and other differences yield the inescapable conclusion that the proposed combination of Takeshita and Tellefson.

Further, the 'evidence of Parniske' is not helpful, as Parniske adds nothing relevant to the teachings of Takeshita or Tellefson individually or in combination, for the reasons set forth above.

Respectfully submitted,

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